Election/Restrictions

In view of applicant's response to election of species, the applicants have elected epoxy/amine system and nanoclay as filler. However, the election of species has been based on the original claims as filed.

The election of species is deemed to be proper, since there is a difference between compounding glass flakes as filler compared to compounding nanoclay or nanoclay composite as filler. Specifically, one difference lies in compatibility between matrix polymer and filler, hence the composition in itself may be different due to presence of compatibilizing agents.

The election of polymeric matrix is also viewed as proper, since there is a different in utilizing an epoxy resin versus polyurethane. The examiner however is willing to withdraw the type of curing agent. Therefore prosecution of the instant invention will include epoxy resin with curing agent that is either amine or anhydride. Compounds citing additional monomers will result in, for example, polyurethane type polymers or acrylics, which are chemically distinct.

1. Restriction is required under 35 U.S.C. 121 and 372.

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1.

In accordance with 37 CFR 1.499, applicant is required, in reply to this action, to elect a single invention to which the claims must be restricted.

Group I, claim(s) 14-26, drawn to composition comprising nanoclays and epoxy resin.

Group II, claim(s) 26-27, drawn to process of making a model.

2. The inventions listed as Groups I and II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

Group I, which is directed to the composition claims, lacks common inventive features of Group II, which does not contain any compositional limitations. In addition the process of claim 27 can be practiced with any composition capable of forming a paste and curing as per disclosed steps.

3. During a telephone conversation with Robert Holtus on 6/11/09 a provisional election was made with traverse to prosecute the invention of Group I, claims 14-26. Affirmation of this election must be made by applicant in replying to this Office action. Claims 27 and 28 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

4. The examiner has required restriction between product and process claims. Where applicant elects claims directed to the product, and the product claims are subsequently found allowable, withdrawn process claims that depend from or otherwise require all the limitations of the allowable product claim will be considered for rejoinder. All claims directed to a nonelected process invention must require all the limitations of an allowable product claim for that process invention to be rejoined.

In the event of rejoinder, the requirement for restriction between the product claims and the rejoined process claims will be withdrawn, and the rejoined process claims will be fully examined for patentability in accordance with 37 CFR 1.104. Thus, to be allowable, the rejoined claims must meet all criteria for patentability including the requirements of 35 U.S.C. 101, 102, 103 and 112. Until all claims to the elected product are found allowable, an otherwise proper restriction requirement between product claims and process claims may be maintained. Withdrawn process claims that are not commensurate in scope with an allowable product claim will not be rejoined. See MPEP § 821.04(b). Additionally, in order to retain the right to rejoinder in accordance with the above policy, applicant is advised that the process claims should be amended during prosecution to require the limitations of the product claims. **Failure to do so may result in a loss of the right to rejoinder**. Further, note that the prohibition against double patenting rejections of 35 U.S.C. 121 does not apply where the restriction requirement is withdrawn by the examiner before the patent issues. See MPEP § 804.01.

WO 2007/055498 – it is examiner's position that applicant's invention is also fully described or anticipated in above WO document. However, WO patent cannot be utilized as a prior art since it has been filed and published after effective filing date of the instant invention.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

7. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

8. Claims 14-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over PINNAVAIA (US 5,853,886).

The prior art of PINNAVAIA discloses process for making epoxy nanocomposites. The goal of the teaching of PINNAVAIA is to form concentrate of clay and curing agent or clay and prepolymer and by such improve intercalation, exfoliation of clay component and dispersion of the clay within polymeric composition.

Clays of PINNAVAIA are swellable smectite type clays capable of swelling and undergoing cationic exchange. Preferred clay is montmorillonite and mica (col. 8). The clays have diameter between 20-20,000 nm and aspect ratio of 20,000:1 to 20:1 (col. 7). The clay of PINNAVAIA is decribed as one being modified by either acid treatment or ammonia (examples) as well as long chain (C18) ammonium compounds (col. 8). The amount of clay as disclosed in the examples can be up to 55 % (col. 19) when in concentrate. Final nanocomposite has clay content 5% (col. 20 and 21 examples) and 1% (col. 24 example).

Amine of PINNAVAIA is a curing agent for the epoxy. Preferred is Jeffamine, which is amine containing polyether compound. Viscosity of Jeffamine (liquid) reads on applicant's claim as it is below 300,000, especially when Jeffamine type curing agents are enabled by the applicants.

Epoxy polymer of PINNAVAIA includes Epon 828 (tradename viscosity of 13000), which also reads on applicant's invention.

Upon combination of the three components the viscosity of the composition is expected to increase dramatically for at least two reasons: one, is that the addition of jeffamine to epoxy results in crosslinking which, and second, is that clay itself is a gelling agent. When combined with jeffamine it will form gel or paste. Epoxy and Jeffamine are utilized in stochiometric

In his search for providing better dispersion and layer separation, PINNAVAIA discloses two processes. One forms clay/Jeffamine concentrate and incorporates the concentrate into epoxy resin (see example E6). Second example forms concentrate comprising epoxy and clay, then the concentrate is incorporated into Jeffamine curing agent. Therefore the prior art of PINNAVAIA teaches that the nanoclay can be added to both epoxy and curing agent.

In the light of the above disclosure, it would have been obvious to one having ordinary skill in the art at the time of the instant invention to add clay to both epoxy prepolymer as well as jeffamine curing agent and therefore obtain the claimed invention. Such modification would still provide PINNAVAIA with clay having increased layer separation and improved dispersion.

The combination of two known compositions is expected to work in additive or cumulative manner. *In re Kerkhoven* 626 E.2d 846, 850 205 USPQ 1069, 1072 (CCPA 1980). Therefore it would have been obvious to use epoxy/nanoclay composite with jeffamine/clay nanocomposite and still obtain the cumulatively the same invention. The combination of two compositions, each of which is taught by the prior art to be useful for the same purpose, in order to for a third composition that is to be used for the very same purpose may be prima facie obvious. *In re Susi*, 440 F.2d 442, 445, 169 USPQ 423, 426 (CCPA 1971).

9. Claims 24-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over PINNAVAIA as applied to claims 14-23 above, and further in view of TWARDOWSKA (WO 03/051282).

The difference between the present invention and teachings of PINNAVAIA is presence of fillers.

The prior art of TWARDOWSKA discloses epoxy/clay nanocomposites cured with amine, which can further contain 10-100 wt % based on weight of clay of filler, wherein filler is selected from calcium carbonate, talc, kaolin, silica or alumina. Fillers such as silica has pendant -OH groups on its surface, therefore it will by default interact with clay.

Fillers such as silica are utilized to improve mechanical properties of the molding compositions and the choice of filler depends on the intended use of the composition. Silica, for examples is well known for its use as pigment or reinforcing filler.

Since the epoxy systems are two part system using all ingredients in at least 1:1 ration would have been obvious to one having ordinary skill in the art, since the final composition would still maintain the same percentage of components overall.

In the light of the above disclosure, it would have been obvious to one having ordinary skill in the art at the time of the instant invention to utilize additional silica filler in order to improve mechanical properties of the composition of PINNAVAIA. Such modification would still provide composition suitable for molding.

10. Claims 24-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over PINNAVAIA as applied to claims 14-23 above, and further in view of ZILG (US 6,197,849).

The difference between the present invention and teachings of PINNAVAIA is presence of fillers.

ZILG discloses epoxy/nanocomposite composition cured with either amine or anhydride. The composition comprises nanoclays and filler, wherein nanoclays encompass those disclosed in PINNAVAIA. ZILG teaches that amount of clays in range of 0.5-30 wt% and amount of fillers of up to 70 wt% provides molding composition having improved mechanical properties. Specifically, fillers include quartz (SiO_2 or silica) and chalk ($CaCO_3$).

Since the epoxy systems are two part system using all ingredients in at least 1:1 ration would have been obvious to one having ordinary skill in the art, since the final composition would still maintain the same percentage of components overall.

In the light of the above disclosure, it would have been obvious to one having ordinary skill in the art at the time of the instant invention to utilize additional silica filler in order to improve mechanical properties of the composition of PINNAVAIA. Such modification would still provide composition suitable for molding.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Katarzyna Wyrozebski whose telephone number is (571) 272-1127. The examiner can normally be reached on Mon-Thurs 8:30 AM-2:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Wu can be reached on (571) 272-1114. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Katarzyna Wyrozebski/
Primary Examiner, Art Unit 1796
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